

IMAGERY IN THE AGED

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IMAGERY IN THE AGED

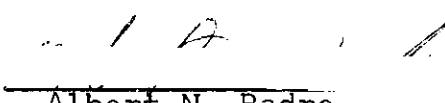
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SUMMARY

It has been reliably demonstrated that recall scores tend to decrease with increasing age. If the deficit performance of the elderly is due to inappropriate mediation or ineffective retrieval at the time of recall, then age differences should be minimized when the elderly are given proper instructions and are taught the use of effective mnemonic systems.

The present experiment was designed to examine the conditions under which the peg-word mnemonic technique facilitates recall in three adult age groups. The type of mnemonic device (concrete versus abstract), the rate of presentation (five-second versus self-paced), and the type of word lists (abstract versus concrete) were manipulated. Instructions included the use of imagery; that is, subjects were told to form a mental picture associating each peg word of the mnemonic device with a to-be-recalled item.

Hypotheses were made regarding all four main effects and the interactions between age and the other variables included in the study. The results failed to show an effect of device concreteness; the performance of subjects in the concrete mnemonic condition did not differ statistically from the performance of subjects in the abstract mnemonic condition. Age, presentation rate, and list type were all found to be

significant variables. As predicted, the young subjects were superior to the older subjects, self-paced lists resulted in better performance than those presented at a five-second rate, and finally, a greater number of words were recalled from the concrete lists than from the abstract lists.

A significant interaction was found between age and list type. The concreteness of the list was shown to produce a smaller effect with the oldest subjects. It was suggested that the concreteness effect is a function of the subject's use of imagery. The elderly seem unable to use imagery mediation effectively, and therefore do not benefit from item concreteness when instructions to image are used.

CHAPTER I

INTRODUCTION

Laboratory studies of learning and memory generally reveal poorer performance for elderly adults relative to younger ones (see reviews by Jerome, 1959; Kay, 1959; Arenberg, 1973). That learning scores tend to decrease with age has been amply demonstrated, but that learning ability declines with age can only be inferred. It is important that we define the problem more specifically. By determining the extent of the age deficit under various experimental conditions we will gain a better understanding of the significant variables. This knowledge will guide the development of strategies designed to aid the elderly in improving learning and recall performance. As Welford (1958, p. 225) has stated,

It is clear that the decline of performance with age at most learning tasks must be accepted as well-established fact. What we need to know is the nature of the difficulty encountered by older people . . .

The Retrieval Hypothesis

Age-related memory deficits have been explained in terms of the greater difficulty the aged experience in storing items in memory at the time of learning (Drachman and Leavitt, 1972; McNulty and Caird, 1966, 1967). Other investigators have taken the position that the problem results

from the inability of the aged to retrieve information from memory effectively at the time of recall (Craik and Masini, 1969; Schonfield, 1965, 1967; Schonfield and Robertson, 1966). Findings have generally supported the retrieval hypothesis which has been emphasized in recent gerontological research.

Recall is assumed to involve two processes, search of the memory store to locate the item (retrieval) and subsequent recognition of the retrieved item as appropriate for recall. Recognition memory, on the other hand, is assumed to involve less retrieval than recall; stimulus items are merely matched with information in storage. Recognition memory, therefore, is synonymous with the second stage in the two-process recall theory. Schonfield (1965) administered recall and recognition tests to subjects ranging from 20 to 75 years of age. No decline with age was found with the recognition scores, but there was a significant decrease with age in the recall scores. Using the above distinction between recall and recognition, Schonfield concluded that the older subjects demonstrated a loss in ability to retrieve memories from storage. This finding has been replicated by Craik (1971) and Smith (1975).

Schonfield suggested two strategies which may aid the elderly in overcoming their retrieval problem, an increase in the amount of rehearsal or an increase in the number of cues which might lead to the stored items. Laurence (1967a) investigated the relative effectiveness of these two strate-

gies. Elderly (mean age 75 years) and young (mean age 20 years) adults were given a single learning and recall trial on 36-word lists composed of six words selected from each of six different categories (e.g., vegetables, animals, etc.). Subjects in each group were cued with the category names before the list was presented. Other subjects were only given the category names to refer to during the recall period. A third group of subjects, a non-cued control group, was also included in the experiment. When the list of category names was provided before list learning, but not at the time of recall, it was considered to be a rehearsal device. However, the results showed no significant interaction between age and rehearsal opportunity. When the list of category names was provided at recall testing, it was assumed that the names served as cues to the stored items. Under this condition the scores of the young and elderly subjects did not differ significantly. These results indicated that the retrieval problem can be substantially reduced, or even eliminated, when elderly subjects are provided with cues at recall to aid retrieval of the list items.

Further support for the retrieval-deficit hypothesis is provided in the work of Craik (1968). In one experiment young and old subjects were tested for recall of 30-word and 10-word lists. List items varied from unrelated words to meaningful text. It was shown that while the younger subjects recalled more words from the long list than from the

short list, the older subjects recalled about the same number of words from both lists. When digits were used with list lengths of four to nine items, no interaction was found between age and list length. Since the results for words and digits differed, Craik suggested that recall of words requires a greater amount of search and therefore puts the elderly at a disadvantage. When the learning material is drawn from a small class, such as digits, a minimal amount of search is required and age differences are small.

Craik (1968) applied the two-store model (e.g., Atkinson and Shiffrin, 1968; Waugh and Norman, 1965) to the retrieval hypothesis. According to most two-storage models, information enters primary memory where it is subject to rapid decay or interference. Craik suggested that age deficits are not found in primary memory, but in secondary memory where both search and retrieval are necessary.

The finding that list length differentially affects the recall performance of young and old subjects is consistent with this model. When lists are within the immediate memory span, the items are recalled from primary storage and little, if any, age difference is found. When list lengths are longer, some of the items must be retrieved from secondary storage. The elderly tend to have poor recall on longer lists presumably because of the increased number of words which must be retrieved from secondary memory.

More evidence for the argument of an age-related re-

lated retrieval deficit is provided in a study by Laurence (1967b). Young and old subjects were presented with two lists of words. One list consisted of 12 nouns selected from a single category; the other list was composed of 12 unrelated nouns. The younger subjects recalled a greater number of items from both lists, but the age difference was largest for the unrelated noun list. For unrelated nouns, the scope of the search is large. The fact that a large age difference was found in the recall of such words is, therefore, further evidence for the retrieval hypothesis.

In summary, it seems that retrieval is a major candidate for the locus of the age-related memory deficit. It has been shown that when strategies designed to aid retrieval are employed, age differences are minimized.

Paired-association

Although most learning or memory tasks show a decline in performance with increasing age, the largest percent loss with age has been shown with the paired-associate task (Ruch, 1934; Gilbert, 1935, 1941; Korchin and Basowitz, 1957). In an early experiment, Gilbert (1941) administered a battery of eleven tests to 174 old (60-69 years) and 174 young (20-29 years) subjects. She compared the magnitude of the age deficit for the different tasks and found the deficit to be greatest with paired-association.

In the paired-associate task the subject is presented

with a series of stimulus-response pairs (e.g., BALL-HOUSE). The subject is required to learn the association between the two items so that given the stimulus term alone (BALL-?) he will be able to provide the correct response term. Underwood and Schultz (1960) have proposed that paired-associate learning is a two stage process. The first stage is response learning. The second stage the associative stage, involves learning the appropriate stimulus-response linkage. During the test trial the stimulus serves as a retrieval cue for the response term. The poor performance of the elderly with this paradigm may, in part, be due to the age-related retrieval deficit discussed earlier.

Another reason might be the difficulty which older individuals seem to experience in developing associations between words (Riegal, 1965). It has been suggested that the preexisting linguistic habits of the elderly are stronger than the habits of younger adults, and that these habits may interfere with the formation of new verbal associations (Arenberg, 1973). A number of studies have investigated this possibility (Canestrari, 1966; Kausler and Lair, 1966; Lair, Moon, and Kausler, 1969; Zaretsky and Halberstam, 1968). Canestrari (1966), for example, presented a list of 10 paired-associates to young and old subjects. Half of the subjects in each age group learned a list composed of pairs of high associative strength (as determined by word association norms) and the other subjects learned a list composed of pairs of low

associative strength. A significant age by list interaction was found. Although the young subjects scored significantly better than the older subjects on both types of lists, the age difference was largest for the low associative strength list. Since the low strength associations are more likely to be compatible with already established linguistic habits, Canestrari (1966) concluded that the linguistic habits of the elderly tend to have a detrimental effect on the learning of new associations.

Lair, Moon, and Kausler (1969) also provided support for the associative-strength hypothesis. Old and middle-aged adults learned one of two paired-associate lists. One list was formed from zero-strength pairs; the other list, a high response competition list, was formed by breaking up high associative-strength pairs and matching each stimulus word with the response word of another pair. As predicted, the age difference was much larger for the response-competition list than for the zero associative-strength list, because of the strong, preexisting linguistic habits.

Mediation

Substantial evidence in the literature (e.g., Monague, Adams, and Kiess, 1966; Paivio, 1969) indicates that mediational techniques play an important role in learning paired-associations. Presumably, the formation of a mediator aids in the association between the stimulus and the response, and

response retrieval can occur through the mediator.

According to Paivio's (1969) two-process theory, there are two types of mediational sets the subject can use. The subject can either develop verbal or visual associations. These processes interact differentially with abstract and concrete stimulus materials. Visual mediators, linkages based on pictures or images associated with the words, are supposed to be more effective in learning concrete words; and verbal mediators, which are based on the formal linguistic characteristics of the words, are assumed to be insensitive to the concreteness of the to-be-learned items.

Since items differ in their image-evoking values, imagery mediation can be experimentally manipulated by varying the type of learning material used (e.g., Paivio, 1965). A second way in which mediation can be manipulated is by the type of instructions given the subject (e.g., Paivio, 1969). Subjects instructed to use imagery, do in fact use imagery more often than subjects given other forms of instruction.

Hulicka and Weiss (1965) noted that, without imagery instructions, older subjects reported using mediators less often than did young subjects. When the elderly did report the use of a device, it was often an inappropriate one. It was suggested that the large age deficit found in paired-associate learning may be a result of age differences in the use of mediators.

Hulicka and Grossman (1967) investigated the use of

mediators in young (mean age 16 years) and old (mean age 74 years) subjects under a variety of instructions. Unrelated common nouns were presented as a paired-associate task. When subjects were specifically told to use mediational techniques the reported use of mediators increased for all subjects and there was a corresponding improvement in recall scores. The elderly improved more than the young subjects, but did not attain the same high level of performance. Learning scores for the older subjects were highest when subjects were instructed to develop their own association between pairs rather than use an experimenter-provided visual or verbal mediator. This result may be indicative of the hypothesized rigidity of the elderly. If the subject forms his own associative link he has the opportunity to use previously established links, whereas an associative link provided by the experimenter might interfere with preexisting linguistic habits.

Even though research has indicated that techniques which involve visual imagery are most effective (Paivio, Yuille, and Smythe, 1965), Hulicka and Grossman (1967) found that the elderly tend to form verbal rather than visual associations. To investigate why aged subjects tend to use the less efficient verbal mediators more often, Canestrari (1968) provided both kinds of mediators to two age groups (16-27 years and 50-73 years). It was hypothesized that the pictures, which were to serve as the visual mediators, would

aid the older subjects to a greater degree than would experimenter-provided phrases, the verbal mediators. The older subjects were greatly benefited by both types of mediator, but the two types seemed to have equally facilitative effects. Further analysis of the recall data for the aged subjects showed that the mediators reduced the number of errors of commission (the overt errors or intrusions), while the number of errors of omission (the nonresponses) remained the same. Canestrari (1968) suggested that with the benefit of mediational techniques the elderly become more confident and less cautious about responding.

It clearly has been demonstrated that instructions to use imagery-mediating strategies facilitate the performance of both young and old adults. If imaginal mediation is used more often with concrete words, as is suggested by the two-process theory (Paivio, Yuille, and Smythe, 1966; Paivio, Smythe, and Yuille, 1968), then concrete items should be easier to learn than abstract items, and this should be true for subjects of all ages.

Rowe and Schnore (1971) investigated the spontaneous use of mediators by young (mean age 18 years), middle-aged (mean age 50 years), and old (mean age 73 years) subjects. All subjects were given standard paired-associate learning instructions. They were then presented with a list which consisted of six concrete and six abstract pairs arranged in

a random order. Both study and test trials were self-paced. List learning continued until a subject reached a criterion of two successive perfect trials or until the eighth trial, whichever came first. The young subjects had higher recall scores than the middle-aged subjects, who performed significantly better than the elderly. Pair concreteness was found to be a significant variable for all age groups, that is, more concrete pairs were recalled than abstract pairs. There was a significant age by pair-type interaction, concreteness showing its greatest effect with the oldest subjects. The authors caution, however, that the interaction may be due to a ceiling effect in the learning of concrete pairs by the two younger age groups. In addition, it should be pointed out that no instructions to image were used in this experiment.

Following the paired-associate task, subjects were questioned as to what methods they used to learn the pairs. Three alternative methods were suggested by the experimenter - repetition verbal mediation, or imagery. The young and middle-aged groups reported a greater use of all three strategies than the old group. The oldest subjects used strategies more frequently for concrete pairs, while the young subjects used strategies more frequently for abstract pairs. As the two-process theory would predict, all age groups reported using verbal mediators more often for abstract pairs, and imagery more often for concrete pairs.

It is difficult to make a conclusive statement regarding the relative effectiveness of verbal and imaginal mediational strategies. The findings presented in the above discussion suggest that the facilitative effect of item concreteness in young adults is due to a greater use of imaginal mediators with concrete items. The elderly reportedly use imaginal mediators less frequently than younger subjects do, and this suggests that item concreteness would produce less of an effect in the elderly. Only one experiment reports a large concreteness effect with older subjects. But in that experiment no imagery instructions were used and the possibility of a ceiling effect existed. If we are to assume that subjects are capable of correctly identifying the strategies which they use, then the data suggest that factors other than the differential use of imagery are involved. The age of the subjects and the type of instructions given are two factors which should be considered.

Presentation Time

The pacing of experimental events appears to be an important consideration when comparisons of learning and memory are being made across age groups. The performance of older individuals is often improved under slow- or self-paced conditions (Canestrari, 1963; Eisdorfer, Axelrod, and Wilkie, 1963).

In paired-associate learning, stimulus materials are

usually presented at a rapid rate. Canestrari (1963) suggested that the poor performance exhibited by the elderly with this task is not due to an inability to learn, but may be related to the pacing conditions. To test this hypothesis, Canestrari (1963) compared elderly (60-69 years) and young (17-35 years) adults under three different pacing schedules - fast (1.5 seconds), medium (3 seconds), and self-paced. The results were consistent with the experimental hypothesis; the self-paced schedule led to faster paired-associate learning in older subjects than the paced schedules did, while no pacing effect was found for the younger subjects.

Further age comparisons were made for the number of omission and commission errors. It was found that the age by pace interaction was a result of a decrease in omission errors for the elderly under the self-paced condition. Although this condition allowed for unlimited study and response time, the elderly require more time to express what they have learned and self-pacing has a beneficial effect because it allows subjects to take additional time in making their responses.

The pacing effect was further investigated by Arenberg (1965). Elderly (60-77 years) and young (18-21 years) adults learned paired-associates in a procedure which included self-paced trials (without feedback) alternated with paced trials. For half of the subjects in each age group fast-paced trials (1.9 seconds) were alternated with self-paced trials; the

remaining subjects experienced slow-paced trials (3.7 seconds) alternated with self-paced trials. The inspection interval was constant under all conditions; only the anticipation or recall interval was varied. This procedure was designed to separate the errors resulting from insufficient time to respond from actual failures in learning. Arenberg reasoned that if the elderly subjects learned during fast-paced trials but found the response time insufficient, they would make a significantly greater number of errors during fast-paced trials than during self-pacing. However, if the elderly did not learn the pairs well during fast-paced trials, then their performance scores would be poor during self-pacing.

An age by pace interaction was found for self-paced errors as well as for paced errors. The age difference was largest when subjects were exposed to fast-paced trials followed by self-paced trials. From these results Arenberg concluded that the pacing effect can not be completely attributed to an insufficient amount of time to express correctly learned responses.

A more recent study by Monge and Hultsch (1971) examined the interaction between inspection and anticipation intervals. The two intervals were independently varied with durations of 2.2, 4.4, or 6.6 seconds. All nine possible combinations of pacing conditions were included in the experiment, the fastest pace having both the inspection and anticipation intervals at 2.2 seconds, and the slowest pace having

the two intervals at 6.6 seconds.

The results were consistent with both Canestrari's (1963) and Arenberg's (1965) data. As either interval duration increased, the performance scores of both the old (40-66 years) and the young (20-39 years) subjects improved. When the anticipation interval was increased the older subjects improved more than the younger subjects did.

Hulicka, Sterns, and Grossman (1967) reported results which confirm those of Canestrari (1963) but require a somewhat different interpretation. Their study was designed to test the effects of paced (3 seconds) and self-paced study and response schedules on the paired-associate learning scores of young (mean age 16) and elderly (mean age 70) subjects. All subjects were instructed to use mediating connections between the word pairs. Four experimental conditions were used; limited study and limited response time (LL), limited study and unlimited response time (LU), unlimited study and limited response time (UL), and unlimited study and unlimited response time (UU). Manipulations in study and response times had parallel effects on the two age groups. No difference was found between the LL and LU conditions. The UL condition was superior to both the LL and the LU condition and the UU condition resulted in the highest level of performance. Thus, for all subjects self-pacing during the learning of pairs improved performance regardless of the dur-

ation of the response interval. Self-paced response schedules were only effective when the study time was also self-paced.

Canestrari (1963) concluded that the effectiveness of self-pacing schedules is due to the increased time made available for responding. However, it can not be determined from the design of his experiment just how the older subjects made use of the extra time. The time may have been used to rehearse preceding word pairs rather than to select an appropriate response. The data of Hulicka and Grossman (1967) and Hulicka, Sterns, and Grossman (1967) suggest that had Canestrari's subjects received mediational instructions, they may have employed the extra time to develop associations and further increases in performance scores might have been revealed.

It should be pointed out that there is a major procedural difference between Hulicka, Sterns, and Grossman's (1967) study and the other studies discussed here. Hulicka et al. used a single study trial and a single test trial per list. The other experiments mentioned involved the presentation of paired-associate items over several trials. Increases in the anticipation interval showed a limited effect in the Hulicka et al. results. It may be that the strength of the effect is dependent upon the probability of rehearsal which would increase with repeated list presentations (Arenberg, 1973).

An experiment by Treat and Reese (1974) employed the paired-associate anticipation method to look at performance as a function of mediating instructions and as a function of anticipation and inspection intervals. Younger subjects (mean age 30 years) performed better than the older subjects (mean age 70 years) in all but two conditions. When the anticipation interval was long (6 seconds) and subjects were instructed to use self-generated imagery, all subjects performed equally well. When anticipation and inspection intervals were short (2 seconds) and standard paired-associate instructions were given, all age groups performed at the same low level. Different interval manipulations did not affect the performance of the younger groups, but did affect the older subjects. This finding indicates that the inferior performance of elderly subjects is partially a result of their needing additional time for decoding the correct response.

Though the learning performance of elderly subjects tends to improve on self-paced schedules, and also tends to improve when subjects are instructed to use mediators, a deficit is often still evident. Reports indicate that older subjects continue to use fewer mediators than younger subjects do, and those that they do use are the less efficient verbal ones. Training of the elderly in the development of more effective visual mediators might further reduce the deficit.

The Peg Word Mnemonic System

The use of mnemonic systems is one way to train subjects to use visual mediation. Experiments using the peg-word system, for example, have provided impressive evidence of the effectiveness of visual mediators in associative learning. It is believed that this strategy primarily aids retrieval. As Paivio (1968, p. 244) stated,

This technique changes what is essentially a free-recall situation into paired-associate learning in which the stimulus items are highly familiar and highly differentiated units, and ostensibly makes use of perceptual imagery to mediate response retrieval.

The procedure involved is as follows. The learner first memorizes a number-word rhyme (e.g., one is a bun; two is a shoe; . . .; ten is a hen). He is then given a list of items to learn. The subject is to visualize the object indicated by the peg word of the mnemonic device in some combined visual image with the object in the list. On a recall trial the numbers alone are provided. Each number presumably functions as a cue for a compound image and the correct verbal response is obtained through a decoding process.

The peg words of the mnemonic system are relatively high in concreteness value, that is, they have a high capacity to evoke visual images. It has been assumed that this is an important characteristic of the system. This assumption seems reasonable considering that the image arousing value of the stimulus term in the standard paired-associate learning

task is more important than that of the response term (Paivio, 1965). When subjects are presented with the four possible combinations of abstract and concrete stimuli and responses, superior recall performance is shown for pairs with both concrete stimuli and responses; pairs with concrete stimuli and abstract responses rank second, followed by abstract-concrete pairs and abstract-abstract pairs.

Paivio (1969) investigated the importance of peg word concreteness in the rhyme mnemonic technique. College-aged subjects were presented with two ten-item lists composed of concrete words. The presentation rate for both lists was four seconds. The conditions for the first list were identical for all subjects; standard paired-associate learning instructions were given.

Following recall of the first list, half of the subjects were arbitrarily assigned to a concrete rhyme condition that involved learning the original peg-word rhyme. The other half were assigned to an abstract rhyme condition and were taught a mnemonic rhyme comprised of relatively abstract peg words (e.g., one is fun; two is true; . . .; ten is sin). Half of the subjects in both condition were instructed to use visual imagery in learning the second list. The others were told to merely say the rhyming words to themselves along with the to-be-recalled words. Imagery instructions proved to be an effective feature of the mnemonic rhyme technique; that is, subjects specifically told to picture the peg words

and list items in some association recalled a significantly greater number of second list words than did subjects lacking imagery instructions.

An unexpected finding was that the two rhyme conditions did not differ significantly. These results seem paradoxical when compared to the findings with standard paired-associate learning. Paivio (1971) offers two explanations. First, for abstract pegs subjects might generate an image of a concrete associate. This explanation, however, does not seem to explain why concreteness showed no significant effect without imagery instructions. In the rhyme mnemonic system the peg words are not explicitly presented as are the stimulus terms in paired-associate studies. Since the peg words must be implicitly supplied by the learner, the concreteness variable may become less important while instructions to image become more important.

Although both the standard paired-associate paradigm and the peg-word technique are used to investigate mnemonic systems, the evidence cited above indicates that the two approaches do not yield comparable results. Paivio (1968) reported that imagery instructions facilitate performance when the peg-word technique is used, but in an earlier study (Yuille and Paivio, 1968) it was found that manipulation of imagery instructions for paired-associate learning has little effect on performance. Also, it was noted that the abstractness of the peg list in the rhyme mnemonic system has little

effect on recall (Paivio, 1968) while the abstractness of stimuli in a paired-associate task has a strong effect (Paivio, 1965).

Wood and Bolt (1970) found Paivio's (1968) evidence for the effect of imagery instructions less than convincing. Since Paivio's "non-imagery" control subjects were instructed to repeat the peg words along with the to-be-recalled words, they may in effect have received verbal repetition instructions rather than verbal mediation instructions. And, verbal repetition instructions typically result in poorer performance than verbal mediation or imagery instructions on a paired-associate task (Paivio and Yuille, 1969). If this argument is valid, then type of instruction may have a comparable effect with the two techniques. Wood and Bolt (1970) investigated this possibility by manipulating imagery instructions and peg list concreteness using both the paired-associate and peg-word techniques. Two experiments were performed. The design of the first experiment was patterned after Paivio's (1968) study. Four groups were included in the experiment, three of which were taught the peg word technique. Those subjects were given either imagery, verbal mediation, or repetition instructions. The fourth group, a control group, was not taught the mnemonic rhyme. As in the Paivio experiment, subjects were given one study and recall trial on each of two ten-item lists composed of concrete words. The experimental manipulations followed recall of the first list. Lists

were presented at a four second rate.

The results of Experiment 1 were consistent with Paivio's data but, because of the new control group's performance, were inconsistent with Paivio's conclusion. Imagery mediation was not superior to verbal mediation, and verbal repetition resulted in poorer performance than both verbal mediation and imagery, when either the mnemonic technique or the paired-associate task were used. Thus the results support the hypothesis that the two approaches to the study of mnemonics yield similar results.

Experiment 2 was designed to examine the relative effectiveness of concrete peg lists and concrete stimuli in paired-associate learning. The design was a 2 X 2 factorial with both peg-list concreteness (concrete or abstract) and technique (paired-associate or peg-word) manipulated. Each subject was presented with two ten-item lists. The conditions for first list learning were identical for all subjects. The list consisted of numbers paired with concrete words. The pairs were presented at a three-second rate. The numbers alone were provided at recall.

Manipulations were made prior to the presentation of the second list; subjects learned an abstract (e.g., one-fun) or a concrete (e.g., one-bun) mnemonic device, or were given standard paired-associate instructions. All subjects were told to form mental pictures connecting the peg words or stimuli with the to-be-recalled words. The List 2 procedure

was the same as the List 1 procedure with the exception that for the paired-associate subjects the stimuli were the peg words (e.g., bun or fun) rather than the numbers one through ten. During recall testing the paired-associate subjects were provided with the peg words and were asked to respond with the appropriate list words.

The results of Experiment 2 are inconclusive. Wood and Bolt (1970) did not find an effect of peg concreteness with either the peg-word or the paired-associate method. Although comparable results were found with the two systems, no conclusions can be drawn since the expected concreteness effect with the paired-associate technique was not found. The presentation conditions of Experiment 2 may not have provided the subjects with adequate time to use imagery mediation, and may therefore be the reason that there was no significant concreteness effect. Bugelski, Kidd, and Segman (1968) studied the effects of presentation rate on imagery mediation in paired-associate learning. They found eight seconds to be the optimal time for the formation of an image. The peg-word method was effective at eight, six, and four second presentation rates but was not effective at a two second rate. The effectiveness of the three-second rate used by Wood and Bolt therefore seems questionable.

Santa, Ruskin, and Yio (1973) further investigated the different components of the peg-word mnemonic system by contrasting it with a wide range of verbal instructions.

College-aged subjects were randomly assigned to the conditions of a 2 X 8 factorial design. The two factors of the design were list type (abstract or concrete) and instructions. The instruction conditions included four instructions to use verbal techniques (rote rehearsal, story construction, concrete verbally mediated peg words, and abstract verbally mediated peg words) and four instructions to use imagery techniques (rote imagery, concrete pegs with images, abstract pegs with images, and nonrhyming pegs).

Subjects in all 16 experimental conditions were presented with six lists of ten words each. Recall tests were given after each list. Results indicated that those instructions involving imagery were more effective than other forms of instruction for concrete lists; however, none of the memory instructions were differentially effective for the abstract lists. Although the concreteness of the response term was found to be quite important, the concreteness of the peg word did not have a significant effect in this experiment. These results are also consistent with the findings of Paivio (1968). Santa et al. favor the explanation offered by Paivio, that subjects tend to "concretize" the abstract pegs. This seems particularly likely in the Santa et al. study where subjects were required to use the peg images repetitively to learn several different lists.

Delprato and Baker (1974) recently provided evidence

in support of the idea that peg-word concreteness is a significant variable in both the peg-word and the paired-associate systems. The experiment was designed as a partial replication of Paivio (1968). The procedures were identical to those of Paivio with the exception that a more appropriate control group was used. Control subjects were not taught the mnemonic rhymes; they were simply given standard paired-associate instructions. As predicted, the concrete peg word was superior to the control group, and in contrast with the results of Paivio (1968), the concrete rhyme group recalled a significantly greater number of words than the abstract rhyme group.

A second experiment was designed to directly test the comparability of the peg word and paired-associate techniques. Half of the subjects were assigned to a peg word condition, and half were assigned to a paired-associate condition. Peg word subjects were taught either a concrete or an abstract device. The abstract peg words were used as the stimulus terms for half of the paired-associate subjects, and the concrete peg words served as the stimulus terms for the others. All groups of subjects were instructed to use visual imagery in learning a ten-item, paired-associate list. The study and test trials were given. An analysis of the recall scores revealed a nonsignificant mnemonic system by peg concreteness interaction.

Delprato and Baker (1974) make a convincing argument

for the significance of peg word concreteness in both the rhyme mnemonic system and the standard paired-associate task. The stimulus concreteness effect has been repeatedly shown in the learning of paired-associate lists. The situation with the rhyme mnemonic differs only in that the pegs are not nominally present but implicitly supplied by the learner. Since well-learned retrieval cues can be just as effective in mediating recall when they are externally absent as when nominally present (Delprato and Garskof, 1969), the effect of peg concreteness in the peg-word system should not be attenuated simply because the pegs are implicit.

In summary, there is some question as to whether the paired-associate and the peg word techniques in the study of mnemonics yield comparable results when either imagery instructions or peg concreteness are manipulated. Some data have supported the idea that the two systems are similar, other results have shown the two to be differentially affected.

Statement of the Problem

The present experiment was designed to investigate the conditions under which the peg-word mnemonic technique is an effective aid to memory for subjects differing in age. If the deficit performance in the aged is a result of ineffective mediational techniques or ineffective retrieval at the time of recall, then with proper instructions and with

the use of appropriate mnemonic systems, the elderly should more closely approximate the level of performance demonstrated by the young.

The use of both an abstract and a concrete device was systematically studied across three age groups. Rate of presentation (five seconds or self-paced) and the concreteness of the word lists (concrete or abstract) also were varied within groups in the design. The effect of age and its interaction with the other variables included in the study are of particular interest. Hypotheses regarding all four main effects and second-order interactions with age as a variable are stated below.

H_1 : Age

The superiority of young adults over older adults has been amply demonstrated in studies using the paired-associate task. Therefore, it is predicted that the young subjects in the present study will perform at a higher level than the middle-aged subjects, and the middle-aged subjects will perform significantly better than the older subjects.

H_2 : Device

Though previous studies comparing concrete and abstract mnemonic devices have yielded inconsistent results, it is predicted that the concrete device will be more effective

than the abstract device. This finding would be consistent with the conceptual peg hypothesis (Paivio, 1969).

H₃: Presentation Rate

Bugelski, Kidd, and Segman (1968) found eight seconds to be the optimal presentation rate when subjects are required to form images between paired-associates. Therefore, it is predicted that lists presented at a self-paced rate will result in better performance than lists presented at a five-second rate.

H₄: List Type

A strong facilitative effect of concrete over abstract words has been reliably demonstrated in studies using the paired-associate and the peg word mnemonic techniques. For this reason, it is expected that a greater number of words will be recalled from the concrete lists than from the abstract lists.

H₅: Age X List Type

Older subjects report using imaginal mediators less frequently than younger subjects do. If the facilitative effect of item concreteness is due to a greater use of imaginal mediators with concrete items, then the concreteness effect should be smaller with older subjects. Therefore, it is predicted that concrete lists will be learned more easily than abstract lists and a larger difference

will be found with the younger subjects than with the older subjects.

H₆: Age X Device

The above argument further suggests that if the effect of item concreteness is not dependent upon the nominal presence of the item, then all subjects will be aided more by the concrete device than by the abstract device. The effect will be greater for the younger subjects than for the older subjects.

H₇: Age X Presentation Rate

The recall performance of older individuals is often improved when presentation rates are slow or self-paced. The paired-associate task seems particularly difficult for the elderly and this may be because they require more time to develop associations. It is predicted that recall scores for all subjects will be poorer at a five-second rate than at a self-paced rate. The effect will be greatest with the oldest subjects.

CHAPTER II

METHOD

Subjects

The subjects were 72 healthy active alumni from the Georgia Institute of Technology. Alumni in the Atlanta area were invited to participate in the experiment and received \$3.00 for participating. Only alumni were used to increase the homogeneity of the subject population, by equating socioeconomic class and education level. The digit span test and the vocabulary subtest of the Wechsler Adult Intelligence Scale (1955) were administered to all subjects; no significant mean differences in performance were found among subjects in the three age groups. Individuals included in the experiment were naive regarding the rhyme mnemonic technique.

Design

Subjects were assigned to the conditions of a split-plot, repeated measures design which included the following blocking variables: age (20-39 years, 40-59 years, and 60 years and older), and type of mnemonic rhyme (abstract or concrete). The type of word list (abstract or concrete) and the presentation rate (five-seconds or self-paced) were within subject variables. The design of the experiment is depicted in Table 1. The order of list type and rate of list

Table 1. Design of the Experiment

	Age Group	Order	Concrete List		Abstract List	
			5-sec.	Self-paced	5-sec.	Self-paced
Concrete Device	1	1	*			
		2				
		3				
		4				
	2	1				
		2				
		3				
		4				
	3	1				
		2				
		3				
		4				
Abstract Device	1	1				
		2				
		3				
		4				
	2	1				
		2				
		3				
		4				
	3	1				
		2				
		3				
		4				

* N = 3 subjects per cell

presentation were determined by assigning subjects to the rows of the following Latin Square:

A	B	D	C
B	C	A	D
C	D	B	A
D	A	C	B

A represents an abstract list at a 5-second rate.

B represents an abstract list at a self-paced rate.

C represents a concrete list at a 5-second rate.

D represents a concrete list at a self-paced rate.

Procedure

Subjects were run individually in the Human Learning Laboratory at the Georgia Institute of Technology. First, the subjects were administered the digit span test and the second half of the vocabulary subtest of the Wechsler Adult Intelligence Scale (1955).

Half of the subjects in each age group were then taught to use the abstract rhyme mnemonic technique and the other half of the subjects in each group were taught the concrete rhyme. The experimenter emphasized the formation of mental pictures corresponding to the peg words. Subjects practiced the appropriate number-word rhyme until they reached a criterion of three successive correct recitations.

All subjects were given an example of how their mnemonic system can be used for remembering a series of words by

visualizing the to-be-remembered items in some association with the peg word images. The concrete rhyme subjects were told that if the first item in a list were the word "soap", they might imagine a giant hamburger bun with a bar of soap between the two pieces. Similarly, the abstract rhyme subjects were told that they might imagine the fun that a bar of soap is having at a party. The word "soap" and all other items in the list should then be easily recalled when the numbers are provided as cues for the associated images.

Following the above instructions and pre-experimental training, subjects were presented with lists of words to be memorized using the mnemonic technique. Each subjects was given a single learning and recall trial on each of four ten-item lists. Two of the lists consisted of abstract nouns and two consisted of concrete nouns. Lists were presented at either a five-second rate or at a self-paced rate.

A Kodak Ektagraphic slide projector was used to present the stimuli. Slides were made of the numerals 1 through 10 paired with list items typed in capital letters. The stimuli, number-word pairs, in each list were presented in numerical order.

A slide at the start of each list indicated at what rate the list would be presented. When the rate was self-paced, the subject controlled the duration of stimulus exposure. Each time the subject pressed the control button a new slide was presented. Subjects were told that they might

spend as much time as they wished on self-paced lists. The total time taken in studying each self-paced list was recorded. Following the presentation of the tenth item in both five-second and self-paced lists, a blue light was projected on the screen for a period of 90 seconds. During that time subjects were to demonstrate recall by writing down as many words as they could remember, placing each response beside the appropriate number on the answer sheet. Relay programming equipment controlled the timing and sequencing of the experimental lists.

Subjects were provided with four identical answer sheets, one for each list presented. Recall for each list was measured immediately after its presentation.

Word Lists

Eight different ten-item lists were formed from nouns selected from Paivio, Yuille, and Madigan's (1968) concreteness norms. The lists are provided in the appendix. Four of the lists contain words with low ratings on the concreteness scale (values less than 3); the other four lists contain words with high ratings (values greater than 6). The lists were equated for meaningfulness, frequency, and average word length.

The concrete rhyme condition involves a mnemonic rhyme comprised of relatively high-imagery peg words (Bugelski, Kidd, and Segman, 1968), while the abstract rhyme condition

involves a mnemonic rhyme comprised of relatively low-imagery peg words (Paivio, 1968). These lists were selected because of their use in previous experiments. The two number-word rhymes are given below.

<u>Concrete Rhyme</u>	<u>Abstract Rhyme</u>
1 - BUN	1 - FUN
2 - SHOE	2 - TRUE
3 - TREE	3 - FREE
4 - DOOR	4 - BORE
5 - HIVE	5 - LIVE
6 - STICKS	6 - TRICKS
7 - HEAVEN	7 - GIVEN
8 - GATE	8 - FATE
9 - LINE	9 - TIME
10 - HEN	10 - SIN

CHAPTER III

RESULTS

To insure the comparability of the three age groups, performance on two sub-tests of the Wechsler Adult Intelligence Scale (1955) was measured. The means and standard deviations for performance on the digit span test and the second half of the vocabulary subtest of the WAIS are shown in Table 2. A simple analysis of variance (Kirk, 1968) was performed on the scores and no significant differences were found among the different age groups.

The number of correct responses on the test trials was the dependent variable in this experiment. Errors of commission were rare and were not analyzed. The mean number of words correctly recalled under each experimental condition is presented in Table 3. A split-plot design analysis of variance with repeated measures was used to analyze the recall scores. To insure that univariate analysis procedures were appropriate, the variance-covariance matrices for all age groups were tested for equality and the pooled variance-covariance matrices for all age groups were tested for symmetry using the Box procedure (Kirk, 1968). The variance-covariance matrices were shown to be statistically equivalent ($\chi^2(20) = 29.95, p > .05$) and the pooled matrix was

Table 2. Means and Standard Deviations for Performance on the Digit Span Test and the Second Half of the Vocabulary Subtest of the Wechsler Adult Intelligence Scale

Age Group	Digit Span		Vocabulary	
	Mean	Standard Deviation	Mean	Standard Deviation
1	7.75	.99	28.25	4.36
2	7.63	1.10	28.17	6.43
3	7.25	1.03	30.96	4.51

Table 3. Mean Number of Words Correctly Recalled Under Each Condition

	Age Group	Concrete List		Abstract List	
		5-sec.	Self-paced	5-sec.	Self-paced
Concrete Device	1	8.17	9.58	6.75	7.83
	2	5.92	8.33	3.17	5.08
	3	3.33	3.50	3.00	2.92
Abstract Device	1	7.25	8.42	5.92	7.08
	2	5.00	7.50	3.67	5.92
	3	2.75	6.00	3.17	4.25

found to have the required symmetry ($\chi^2(8) = 8.01, p > .05$).

Table 4 contains the summary table for the overall analysis of variance of the recall scores. All effects were evaluated using the .05 confidence level. Type of mnemonic device (concrete versus abstract) did not have a significant effect in the present study. The performance of subjects in the concrete rhyme condition did not differ statistically from the performance of subjects in the abstract rhyme condition ($F(1,66) = .02, p < .05$). As an indication of whether the mnemonic devices were effective under the conditions of the present study, an additional "no device" control group of 12 young (mean age 35.8 years) subjects was tested using the same materials and experimental procedure. This group was compared with the young group in the experiment. Table 5 gives the means and standard deviations for the comparison. As can be seen, a significant effect was found. A two-tailed t-test showed that the experimental subjects (with a mnemonic device) recalled a greater number of words than the control subjects ($t(34) = 2.78, p < .05$).

The main effects other than type of mnemonic device did prove significant. First, subjects recalled a greater number of words from the concrete lists than from the abstract lists ($F(1,66) = 46.46, p < .05$). Secondly, self-paced trials resulted in better performance than trials with the five-second presentation rate ($F(1,66) = 46.68, p < .05$). Thirdly, age was found to be a significant variable ($F(2,66)$

Table 4. Analysis of Variance Summary Table: Recall Scores

Source	Sum of Squares	df	Mean Square	F
Between Subjects	1498.87	71	-	-
Device (D)	.22	1	.22	.02
Age (A)	772.14	2	386.07	36.98*
D X A	37.72	2	18.86	1.81
Subjects within groups (S)	688.79	66	10.44	-
Within Subjects	1068.00	216	-	-
List Type (L)	144.50	1	144.50	46.46*
D X L	5.01	1	5.01	1.61
L X A	33.40	2	16.70	5.37*
D X A X L	9.88	2	4.94	1.59
L X S	205.21	66	3.11	-
Presentation Rate (P)	168.05	1	168.05	46.68*
D X P	10.13	1	10.13	2.81
A X P	20.01	2	10.01	2.78
D X A X P	17.27	2	8.64	2.40
P X S	237.54	66	3.60	-
L X P	6.13	1	6.13	2.01
D X L X P	.89	1	.89	.29
L X A X P	3.64	2	1.82	.60
D X L X A X P	4.88	2	2.44	.80
L X P X S	201.46	66	3.05	-
Total	2566.87	287	-	-

* $p < .05$

Table 5. Means and Standard Deviations for the Recall Scores
of Young Mnemonic and Control Subjects

	Mean	Standard Deviation
Control Subjects	6.12	1.73
Mnemonic Subjects	7.63	1.36

= 36.98, $p < .05$). A Tukey HSD multiple comparison (Kirk, 1968) was used to indicate the locus of the age effect. The tests revealed that the youngest subjects recalled a significantly greater number of words than the middle-aged subjects, who in turn recalled more words than the oldest subjects.

There were no significant interactions between device and list type ($F(1,66) = 1.61$), device and presentation rate ($F(1,66) = 2.81$), list type and presentation rate ($F(1,66) = 2.01$), age and device ($F(2,66) = 1.81$), or age and presentation rate ($F(2,66) = 2.78$). The only significant second-order interaction was between age and list type ($F(2,66) = 5.37$, $p < .05$). For all three age groups, concrete lists were more easily learned than abstract lists. However, a smaller difference was found between the recall scores for the two list types with the older subjects. In other words, the concrete word list seemed less effective in improving recall for the oldest group. This interaction is presented in Figure 1.

The amount of time taken by the subjects in the self-paced conditions was also analyzed. The mean study time taken during self-paced trials under each condition is presented in Table 6. A split-plot design analysis of variance with repeated measures was used to analyze these data with no significant results (see Table 7).

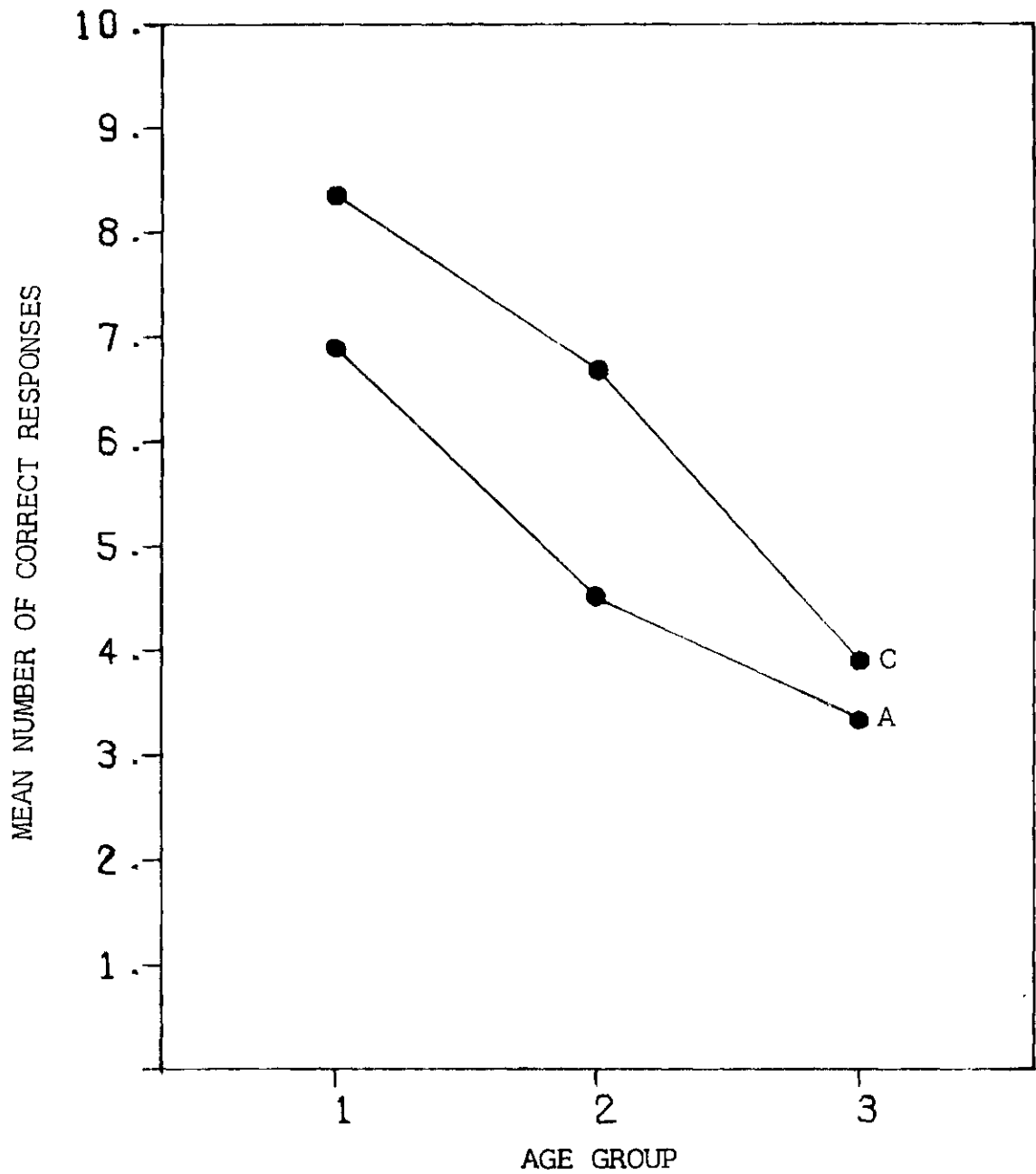


Figure 1. Mean Number of Correct Responses for Concrete (C) and Abstract (A) Word Lists by Three Age Groups.

Table 6. Mean Study Times in Seconds Taken During Self-paced Trials Under Each Condition

	Age Group	Concrete List	Abstract List
Concrete Device	1	115.67	151.50
	2	152.83	141.50
	3	130.00	126.67
Abstract Device	1	119.33	142.58
	2	157.58	170.75
	3	153.25	166.00

Table 7. Analysis of Variance Summary Table: Self-pacing
Times

Source	Sum of Squares	df	Mean Square	F
Between Subjects	496684.89	71	-	-
Device (D)	8341.78	1	8341.78	1.18
Age (A)	13136.76	2	6568.38	.93
D X A	6958.93	2	3479.47	.49
Subjects within groups (S)	468247.42	66	7094.66	-
Within Subjects	115751.00	72	-	-
List Type (L)	4946.78	1	4946.78	3.20
D X L	784.00	1	784.00	.51
L X A	5801.85	2	2900.93	1.88
D X L X A	2267.79	2	1133.89	.73
L X S	101950.58	66	1544.71	-
Total	612435.89	143	-	-

Note. All comparisons were nonsignificant at the .05 level.

CHAPTER IV

DISCUSSION

The purpose of the present experiment was to determine the conditions necessary to produce facilitation of recall using mnemonic devices in three age groups. Variables which research indicates might be important in the effectiveness of mnemonic devices were manipulated.

In the present experiment, abstract and concrete mnemonic devices were found to be equally effective in improving subjects' recall scores. This finding is consistent with the results of Paivio (1968) and Santa, Ruskin, and Yio (1973). Other experiments performed by Wood and Bolt (1970) and Delprato and Baker (1974), however, have found that subjects taught a concrete mnemonic rhyme perform significantly better than those taught an abstract mnemonic rhyme. It is not clear what methodological differences existing among these experiments might cause such opposing results. All of the studies, with the exception of the present study, used college-aged subjects. The same concrete and abstract rhymes were used. Instructions included the use of imagery and all subjects were given an example of how their mnemonic rhyme was to be used to memorize lists of words. Delprato and Baker (1974) replicated Paivio's (1968) study, yet theirs

was one study which supported the idea that peg word concreteness is a significant variable in the peg word system, while Paivio's did not.

In the present study it was predicted that the concrete device would be superior to the abstract device. This prediction was due to the ease with which the peg words evoke images. Since younger subjects reportedly use imagery mediation more often than older subjects do, it was believed that the effect of concreteness would be greater with the younger subjects. Unexpectedly, neither the main effect of device concreteness nor its interaction with the age variable were found to be significant. This author concludes that under these particular experimental condition concrete and abstract mnemonic systems affect recall performance in a similar manner. The functional equivalence of the two systems was demonstrated for all three age groups.

According to the conceptual peg hypothesis (Paivio, 1969) and current imagery theory, stimulus items which are high in concreteness value have a greater capacity to evoke images which serve as mediators to facilitate associative learning. This view has gained considerable support from paired-associate studies. Thus the failure to obtain a facilitative effect of the concrete peg word system over the abstract peg word system is difficult to interpret. Paivio (1971) offers two possible explanations. First, for abstract

pegs subjects might generate an image of a concrete associate. For example, subjects might associate the ninth abstract peg word, time, with an image of a clock. This possibility seems particularly likely when subjects are specifically instructed to form a compound image associating the peg words with the to-be-recalled items. This was done in the present experiment. In fact, a concrete image for an abstract peg was actually given in the instructions. The abstract rhyme subjects were told that if the first item in a list were the word "soap", they might imagine the FUN that a bar of soap is having at a party. In addition, since peg words must be implicitly supplied by the learner in the rhyme mnemonic system, the concreteness variable may be less important than it is in paired-associate studies where stimulus terms are explicitly presented. Informal interviews with subjects following testing has led this experimenter to favor a combination of Paivio's suggestions. The absence of the peg words at recall may increase the likelihood that subjects will "concretize" the abstract pegs, particularly when they are to be used repetitively to learn several lists of words. The solution to this problem will contribute to a better understanding of the comparability of the peg word and paired-associate techniques and to the more general issue of retrieval cues and the conditions under which they are effective.

Presentation time is a variable which affects the per-

formance of elderly subjects. These subjects often show improved performance under slow or self-paced conditions. Some data indicated that the beneficial effect may be attributed to additional response time alone. Other results point to two loci, the inspection interval and the response interval. The response time in the present study was held constant across all conditions at 90 seconds. This was assumed to be sufficient for all subjects. The rate of stimulus presentation was manipulated so that each list was either presented at a five-second rate or at a self-paced rate. It was predicted that although a pacing effect would be seen in all subjects, the greatest effect would be found with the oldest subjects. Since older subjects seem to experience a greater difficulty developing association between items, it was thought that they would make use of the additional time available on self-paced trials to form stronger associations and would thus improve recall scores.

All subjects were able to recall a greater number of items when permitted to pace the stimulus presentation themselves. Unexpectedly, however, the younger subjects and the older subjects showed the same degree of improvement; that is, the pacing effect was similar for all age groups. The amount of time which each subject took on self-paced trials was recorded. An analysis of this data revealed that the time subjects spent studying the items did not differ across age groups.

Two testable hypotheses are suggested by these results. It may be that the older subjects did learn the lists as well as the younger subjects under the self-paced condition, but that the 90-second response interval did not provide enough time for them to express what they knew. A simple test of this hypothesis would involve the manipulation of both study and response times. If the older individuals do require additional time to respond, then they would benefit more from an extended response interval than would the young.

Another possibility is that the inspection interval is the critical interval; that is, the older subjects would improve more than the younger subjects if they spent a sufficient amount of time studying the lists. In the present experiment the older subjects did not study longer than the young. Perhaps an externally controlled slow rate of presentation and specific instructions to make use of all available study time would force the elderly to use the additional time which they need to learn the items and would thus decrease the age difference in recall scores.

It was also hypothesized that the concreteness effect in list or device would be greatest with younger subjects since they presumably use imagery more frequently than older subjects do. While the age by device interaction was found not to be significant, the age by list type interaction was significant. This interaction is depicted in Figure 1. As can be seen in the figure, item concreteness had a smaller

effect on the oldest subjects. This result supports the idea that older subjects do not use imagery mediation effectively, even when specifically instructed to do so. A critical examination of Figure 1 suggests that the greatest loss in ability to deal with concrete items occurs between the middle and late years, while the ability to handle abstract items seems to decline before or during middle age.

It is interesting to compare the results of this experiment with the results of Rowe and Schnore (1971). In that study three age groups of subjects were presented with a single list composed of both concrete and abstract pairs. The task was a paired-associate learning task and subjects were given standard instructions. Rowe and Schnore also found a significant age by item interaction, but in their study concreteness showed its greatest effect with the oldest subjects. Clearly, the methodologies of the two experiments are quite different. Therefore, it is difficult to hypothesize upon what variable or combination of variables the interaction is dependent. The most obvious differences between the two experiments are the type of task (paired-associate versus peg-word technique), the type of instructions (standard paired-associate versus imagery), and the method of presentation (a mixed list design versus a design in which separate lists are composed of concrete or abstract words). If we are to assume that the concreteness effect is a function of the subject's use of imagery, then the type

of instructions would seem to be a most critical variable. With no instructions to image the elderly might ~~perform~~ better with concrete items because concrete items are also easier to verbally mediate. While imagery instructions enhance the concreteness effect for younger subjects, such instructions tend to lessen the effect for older subjects. The older subjects seem unable to use imagery mediation effectively. It seems then that the exclusive use of concrete words is likely to exaggerate age differences in studies including imagery instructions, and underestimate any age differences when standard instructions are employed. Clearly, the predominant use of either abstract or concrete stimulus items may bias the results of any experiment which includes subjects differing in age. Further research should be aimed at this possibility. Of particular value would be a study in which both item concreteness and imagery instructions are manipulated with subjects varying in age. The results of such a study would permit a more detailed analysis of the concreteness effect.

APPENDIX

WORD LISTS

Concrete Lists

- List 1. 1 - VILLAGE
 2 - MOTHER
 3 - FLESH
 4 - COMMITTEE
 5 - AUTHOR
 6 - MATERIAL
 7 - BLOOD
 8 - DOLLAR
 9 - GARDEN
 10 - METAL
- List 2. 1 - TEACHER
 2 - OFFICER
 3 - DRESS
 4 - BUILDING
 5 - JOURNAL
 6 - ANIMAL
 7 - BOARD
 8 - ENGINE
 9 - HOUSE
 10 - RAILROAD
- List 3. 1 - STRING
 2 - HOTEL
 3 - CREATURE
 4 - BREAST
 5 - LETTER
 6 - ARTIST
 7 - BUTTER
 8 - FACTORY
 9 - LIBRARY
 10 - TEMPLE
- List 4. 1 - PERSON
 2 - GENTLEMAN
 3 - CORNER
 4 - BOULDER
 5 - MACHINE
 6 - AUTOMOBILE
 7 - COAST
 8 - FURNITURE
 9 - MAGAZINE
 10 - VALLEY

Abstract Lists

- List 1. 1 - EFFORT
 2 - ADVICE
 3 - STRENGTH
 4 - SAFETY
 5 - PASSION
 6 - GLORY
 7 - ADVANTAGE
 8 - INSTANCE
 9 - SITUATION
 10 - DEVELOPMENT
- List 2. 1 - CUSTOM
 2 - TROUBLE
 3 - SPIRIT
 4 - PRIDE
 5 - NECESSITY
 6 - ATTITUDE
 7 - CHARM
 8 - VICTORY
 9 - KNOWLEDGE
 10 - DEVIL
- List 3. 1 - CHANCE
 2 - THOUGHT
 3 - SHAME
 4 - POWER
 5 - HAPPINESS
 6 - INTEREST
 7 - JUSTICE
 8 - VIRTUE
 9 - EXPRESSION
 10 - MEMORY
- List 4. 1 - ANGER
 2 - THEORY
 3 - QUALITY
 4 - PLEASURE
 5 - HONOR
 6 - METHOD
 7 - FAULT
 8 - MORAL
 9 - CONFIDENCE
 10 - TRUTH

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